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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/789,681	02/28/2004	Ut-Va Koc	3-1	7543

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Lucent Technologies Inc.
Docket Administrator (Room 3J-219)
101 Crawfords Conner Road
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EXAMINER

WILLIAMS, HOWARD L

ART UNIT PAPER NUMBER

2819

DATE MAILED: 07/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

Office Action Summary	Application No. 10/789,681	Applicant(s) KOC ET AL.	
	Examiner Howard L. Williams	Art Unit 2819	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 02 June 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 11-17 is/are rejected.
- 7) ☐ Claim(s) 8-10 and 18 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>060205</u> . | 6) <input type="checkbox"/> Other: _____ |

The examiner acknowledges receipt of the information disclosure statement on 02 June 2005. An initialed copy of the citation form should accompany this letter.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

*A person shall be entitled to a patent unless –
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.*

Claims 1, 2, 4, 5, 7, 11-13 and 15-17 are rejected under 35 U.S.C. 102(b) as anticipated by U.S. Patent 6,518,905 B2 to Siferd. Siferd discloses an interleaved bandpass delta-sigma ADC system for conversion of IF signals. The interleaving permits Siferd to obtain a higher effective sampling rate by placing slower bandpass delta-sigma in parallel with each other. Siferd discloses a sequence of sampling

It will be appreciated that the center frequency of the bandpass filter will depend upon the noise shaping function of the individual $\Delta\Sigma$ modulators 102. The noise shaping function for a single channel bandpass $\Delta\Sigma$ modulator has a value of zero at:

$$f_c = \frac{(2n-1)f_s}{4}$$

where n is an integer equal to or greater than zero. Limiting the range of center frequencies based upon the Nyquist theorem, the center frequency f_c of the bandpass filter is preferably chosen as

$$f_c < \frac{Mf_s}{2} \text{ or } f_c = \frac{f_s}{4}, \frac{3f_s}{4}, \frac{5f_s}{4}, \dots, \left(\frac{Mf_s}{2} - \frac{f_s}{4}\right)$$

in order to diminish the quantization noise by the noise shaping function of the individual bandpass $\Delta\Sigma$ modulators operating at a frequency of f_s .

Accordingly, the center frequency of the parallel time interleaved $\Delta\Sigma$ modulator ADC 100 according to FIGS. 1-3 can be extended to frequencies much higher than a single bandpass $\Delta\Sigma$ modulator operating at a frequency of f_s , which is limited to $f_s/4$, while obtaining the required S/N ratio for high resolution. The parallel time interleaved $\Delta\Sigma$ modulator ADC 100 uses M single channel $\Delta\Sigma$ modulators 102 in parallel to dramatically increase the range of bandpass center frequencies that can be used while retaining and improving the advantages of the $\Delta\Sigma$ noise shaping of the individual modulators.

frequencies to center frequency ratios driven by the number of modulators. Siferd discloses in column 7 about line 50 that the center frequency can be related to the sampling frequency $f_c = 3f_s/4$. See clipped image of column 7 on the left.

The delta-sigma modulator is depicted in figure 3 and comprises filter Hz, quantizer 162, DAC 168 for feedback.

Claims 1, 2, 4, 5, 7, 11-13 and 15-17 are rejected under 35 U.S.C. 102(b) as anticipated by U.S. Patent 5,619,536 A to Gourgue. Gourgue discloses a bandpass delta-sigma ADC IF radio signals (15; fig. 2). The Gourgue device includes a bandpass

filter (3; fig. 2), quantizer (5; fig. 2) and DAC (6; fig. 2). Gourgue also discloses the

sampling frequency as $f_{\text{sampling}} = \frac{4}{2m+1} f_{\text{IF}}$ where m is a positive integer or zero. Thus for

a value of m equal to one gets $f_{\text{sampling}} = 4/3 f_{\text{IF}}$, which corresponds to the sampling frequency claimed in claim two.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 6, 8-10, and 14 are rejected under 35 U.S.C. 103(a) as unpatentable over U.S. Patent 6,518,905 B2 to Siferd in view of Shoaee et al. article Design and Implementation of a Tunable 40 MHz-- 70 MHz Gm-C Bandpass $\Delta\Sigma$ Modulator.

Maurino et al. teach the benefits of higher-order modulators and provides a basic sampling frequency to center frequency ratio of $nf_s \pm f_o$ using a fourth order modulator. Maurino also discloses the beneficial use of return-to-zero DACs as providing high linearity partly due to the reduced energy carried by the DAC pulse.

Claims 3, 6, 8-10, and 14 are rejected under 35 U.S.C. 103(a) as unpatentable over U.S. Patent 5,619,536 A to Gourgue in view of the Maurino et al. IEEE article A 200-MHz IF 11-bit Fourth-Order Bandpass $\Delta\Sigma$ ADC in SiGe.

Gourgue discloses a bandpass delta-sigma ADC as set forth above but does not disclose the forward path filter as a fourth order filter or the DAC as having a return-to-zero implementation. Maurino discloses both of these items: The transfer function equation 5 of one of the two bandpass filters in the left hand column on page 960 shows a second order response and the cascading of the two clearly produces a fourth order filter. The use of a return-to-zero DAC is discussed in the right-hand column of page 960, where among other things Maurino discloses that the use of RZ pulses avoids intersymbol interference. The combination of Gourgue and Maurino would have been

obvious because the fourth order filter improves the SNR by pushing the noise to a higher frequencies and the return-to-zero DAC avoids intersymbol interference.

Applicant's response filed 02 June 2005 has been fully considered but is not persuasive.

The claims in terms of actual circuit elements recite the bandpass filter, the quantizer and DAC. These are the concrete elements of the claims. It is shown above where these elements are found in Siferd, figure 3 including filter H_z , quantizer 162, DAC 168 for feedback. The remaining clause is the one about the mirror image. This clause recites that the series of digital signals has a data carrying frequency spectrum that is a mirror image of the data-carrying frequency spectrum of the input. There is no structure element here and this effect appears to be inherently produced by the chosen sampling frequency. Sampling produces replicas. Siferd discloses a series of sampling frequencies in the series of carrier frequencies and proportion to sampling frequency. Siferd discloses the claimed filter and quantizer and discloses a sampling frequency of $f_s = 4/3 f_c$, easily derived with simple arithmetic operation from the Siferd expression of $f_c = 3/4 f_s$.

While the response correctly notes that the applied prior art must disclose all the claimed features to support a rejection, it is equally if not more important that the claimed features in question are more than a mere recitation of inherent operational features produced by a circuit that is found in the prior art. It appears that in the present application unfortunately the latter of these items applies.


Claims 8-10 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The art of record is not seen to disclose the DAC having duty-cycles of less than one-half. Maurino appears to stop at one-half, page 960.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Bazarjani (US 6538588 B1) discloses a delta-sigma ADC with undersampling applications, wherein the input signal is centered at an IF which is higher than the sampling frequency and the aliasing property of sampling is used to downconvert the input signal from IF to a lower frequency, the input signal should be placed close to $IF = (2n+1) \cdot f_s / 4$, where n is an integer greater than or equal to zero.

Any inquiry concerning this communication should be directed to Howard L. Williams at telephone number 571.272.1815. The Patent and Trademark Office has a new central facsimile number for application specific correspondence intended for entry, it is 571-273-8300.

7/15/05
Voice: (571) 272-1815


Howard L. Williams
Primary Examiner
Art Unit 2819